Space Weather Technical Forecast

Issued on Saturday, 24 September 2022 at 13:02 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 mainly Day 3 due to possible CME influence. Daily Chance of R1 Minor Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity, as measured by GOES-16 and 17 satellites, has been Moderate with a M1.7 flare observed from AR3110 at 23/1810 UTC, near the northeast limb.

There are currently six numbered active regions on the visible disc, with the largest currently AR3105 (Eki/Beta) in the southeast quadrant. AR3107 (Eai/Beta), also in the southeast, is the active region generating most C-class flares flares, and has shown further growth in the intermediate spots. AR3109, in the northwest quadrant, has shown consolidation in the lead portion. AR3110, near the northeast limb, has shown new spot emergence in its intermediate and trailer portions, now a Dsi/Beta. Other regions are largely unchanged.

Previously analysed CMEs from 21st and 22nd may give some glancing influence at Earth late on the 25th and into 26th, however confidence is low.

A large filament eruption and CME observed around 23/1400 UTC has been analysed and misses Earth. A CME associated with the Moderate class flare has also been assessed as missing Earth. A new CME is now seen emerging on coronagraph imagery from the southwest limb. Initial viewing indicates this should be directed off the Sun-Earth line, but modelling will be undertaken when further imagery becomes available to confirm this.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, varied between 385 and 480km/s and showed a slight rising trend which levelled off after approximately 23/2100UTC. The solar wind density was at mostly Average levels with a slight downward trend. The IMF was Weak, varying between 3nT and 8nT. The north-south component, Bz, was also at Weak, fluctuating between +6nT and -7nT, but was often negative (southward). The phi angle was changeable, showing alternating periods of positive (away from the Sun), and negative orientation (towards the sun). Geomagnetic activity was mostly Quiet to Unsettled (Kp 1 to 3), with an Active (Kp 4) interval 24/0300-0600UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, remained very close to Background levels. High energy electron flux (greater than 2 MeV) was at Normal Background to Moderate levels, with peak value 373 pfu at 23/1610 UTC. The associated 24-hour fluence remained well below the Active (1e8 integrated pfu) threshold. Observed fluence at 24/0000UTC was 5.94e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low to Moderate, with further C-class flares Expected and with an ongoing Chance (50%) of M-class flares. The main flare risk remains from AR3105 and AR3107 in the southeastern disc.

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Solar Wind / Geomagnetic Activity: This forecast period comprises a waning coronal hole fast wind (from CH25/+), up to two low confidence CMEs on days two and three (25th and 26th), and perhaps some limited coronal hole influence from CH26/- late in the period.

Ongoing influence from CH25/+ still gives a slight chance of G1 on Day 1 (24th). This should wane into days 2 and 3, however there is a low chance of reaching G1 late day 2, and into day 3 from possible glancing CME influence. Potential influence from CH26/- late in the period should be limited, with G1 currently assessed as being unlikely. In summary, geomagnetic activity is likely to remain mostly below G1 level through the period.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES16, is expected to persist at Background levels.

The high energy electron flux (greater than 2 MeV) is expected to be mostly at Background to Moderate levels, with a low chance of reaching High levels over the next couple of days. Confidence in the forecast is lowered due to possible glancing CME influence perhaps from late on 25th, and into 26th. However, the associated 24-hour fluence is expected to stay below the Active (1e8 integrated pfu) threshold through the period.

MOSWOC REFM looks to be giving better guidance now and is tentatively accepted over the next couple of days.

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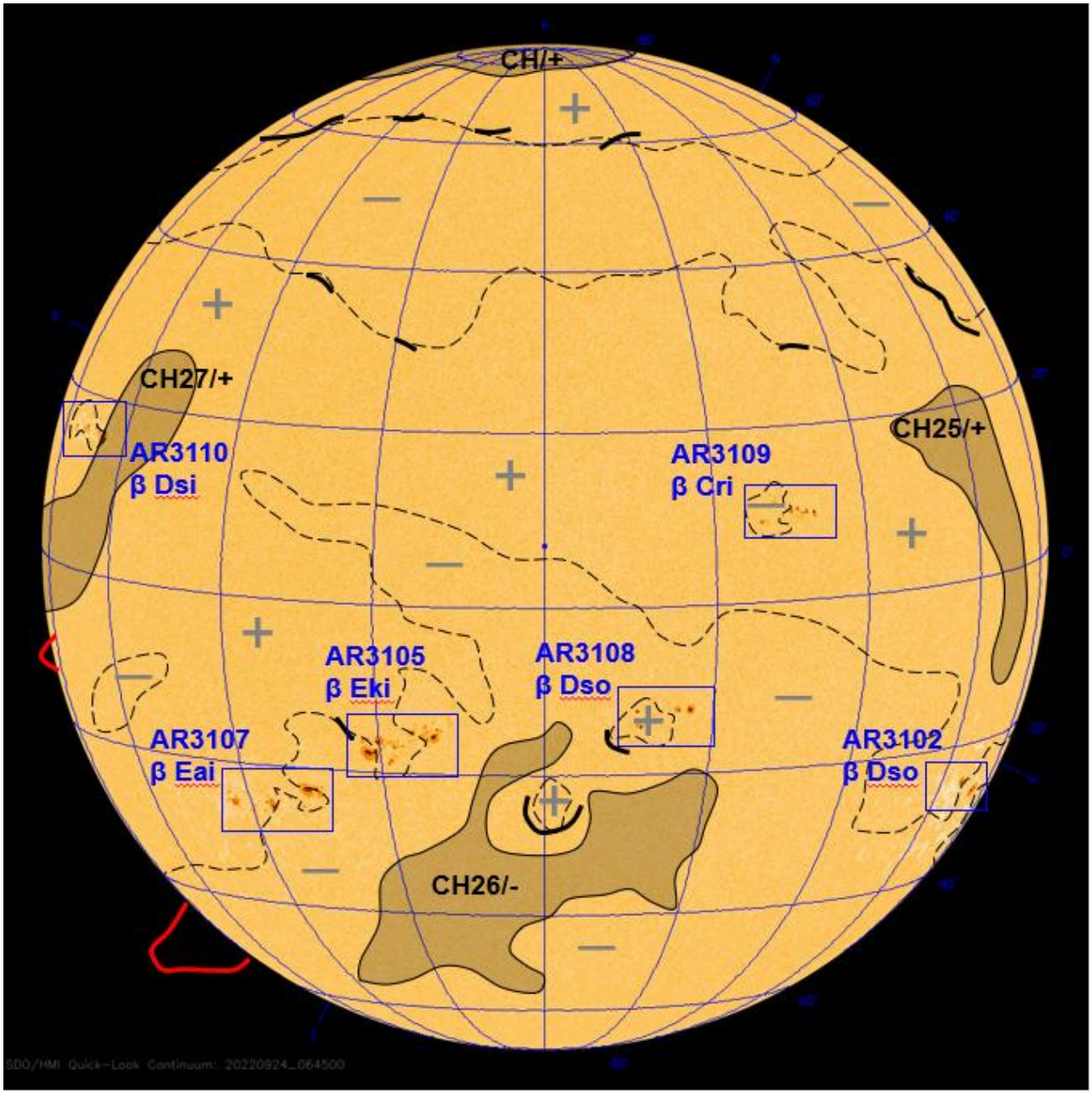
Figure 1. Solar Analysis Valid 24/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

This forecast period comprises a waning coronal hole fast wind (from CH25/+), up to two low confidence CMEs on days two and three (25th and 26th), and perhaps some limited coronal hole influence from CH26/- late in the period.

Ongoing influence from CH25/+ still gives a slight chance of G1 on Day 1 (24th). This should wane into days 2 and 3, however there is a low chance of reaching G1 late day 2, and into day 3 from possible glancing CME influence. Potential influence from CH26/- late in the period should be limited, with G1 currently assessed as being unlikely. In summary, geomagnetic activity is likely to remain mostly below G1 level through the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
22/0532	Partial	SE dis, perhaps AR3105	SE	309	Late 25 Sep	Source uncertain, very low confidence. Probably independent from later CME.
22/2058	Partial	AR3109	Centre NW disc	400	26/0100	Low confidence. Mainly N and W of Sun-Earth line.

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Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate with a M1.7 flare observed from AR3110 at 23/1810 UTC near the northeast limb.

There are currently six numbered active regions on the visible disc, with the largest currently AR3105 (Eki/Beta) in the southeast quadrant. AR3107 (Eai/Beta), also in the southeast, is the active region generating most C-class flares flares, and has shown further growth in the intermediate spots. AR3109, in the northwest quadrant, has shown consolidation in it's lead portion. AR3110, near the northeast limb, has shown new spot emergence in its intermediate and trailer portions, now a Dsi/Beta. Other regions are largely unchanged.
Low to Moderate levels of solar activity are forecast, with the daily Chance of M-class flares assessed to be around 50%.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) observed by GOES16 is expected to remain at or very close to Background levels. The main flare risk sunspots currently populate the southeastern disc, however their gradual westward transit will see an overall slight increase in the risk of S1 (or greater) in the period, with AR3105 probably offering the most significant contribution.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as observed by GOES16, is currently in the Normal Background to Moderate range.

The current influence of CH25/+ could still lift electron populations at Earth, with High flux levels perhaps developing during days two and three (25 and 26 September), although this now seems less likely given the lack of response in recent days to the HSS. Confidence in the forecast is also lowered due to possible glancing CME influence perhaps from late on 25th, and into 26th.

The associated 24-hour fluence is expected to stay below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM looks to be giving better guidance now and is tentatively accepted over the next couple of days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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